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Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of)

Amendment of Part 2 of the)
Commission's Rules to Allocate the)
455-456 MHz, and 459-460 MHz Bands)
to the Mobile-Satellite Service)

ET Docket No. 97-214

REPLY COMMENTS

OF

LEO ONE USA CORPORATION

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FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF THE SECRETARY

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Executive Summary

In this reply, Leo One USA reiterates its view that the Non-Voice, Non-Geostationary Mobile Satellite Service ("NVNG MSS" or "Little LEO") industry has a critical need for additional spectrum and urges the Commission to proceed with the proposed allocation. Leo One USA strongly disagrees with the views of some commenters that NVNG MSS systems will interfere with existing services. As demonstrated in these Reply Comments, several commenters have not taken the time or effort to understand the operations of NVNG MSS systems and the sharing issues raised in this proceeding. The typical response of incumbent users of these bands is that their service is critical, and the introduction of NVNG MSS operations will cause significant harm to existing operations. However, a close examination of NVNG MSS technology and its ability to share with other services reveals that the operations of existing systems will not be harmed in any manner by the introduction of FDMA NVNG MSS systems operating in the 455-456 MHz and 459-460 MHz bands. During the last three years, an extensive record supporting this conclusion has been developed at the FCC, through the WRC-95 and WRC-97 preparatory process, and at the ITU-R. Based on the Little LEO industry's demonstrated requirement for this allocation and the record establishing that NVNG MSS systems can successfully share with terrestrial services, Leo One USA urges the Commission to adopt the proposal to allocate this additional spectrum to the NVNG MSS.

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REPLY COMMENTS

Leo One USA Corporation ("Leo One USA"), by its counsel, hereby submits its reply to the initial comments in the above-captioned proceeding. In this reply, Leo One USA reiterates its view that the Non-Voice, Non-Geostationary Mobile Satellite Service ("NVNG MSS " or "Little LEO") industry has a critical need for additional spectrum and urges the Commission to proceed with the proposed allocation. Leo One USA strongly disagrees with the views of some commenters that NVNG MSS systems will interfere with existing services. As demonstrated below, these commenters have not taken the time or effort to understand the operations of NVNG MSS systems and the sharing issues raised in this proceeding. The typical response of incumbent users of these bands is that their service is critical, and the introduction of NVNG MSS operations will cause significant harm to existing operations. However, a close examination of NVNG MSS technology and its ability to share with other services reveals that the operations of existing systems will not be harmed in any manner by the introduction of FDMA NVNG MSS systems operating in the 455-456 MHz and 459-460 MHz bands. During the last three years, an extensive record supporting this conclusion has been developed at the FCC, through the WRC-95 and WRC-97 preparatory process, and at the ITU-R. Based on the Little LEO industry's demonstrated requirement for this

allocation and the record establishing that NVNG MSS systems can successfully share with terrestrial services, Leo One USA urges the Commission to adopt its proposal to allocate this additional spectrum to the NVNG MSS.

I. The NVNG MSS Has Immediate Requirements for Additional Allocations

A number of commenters have questioned the need for additional NVNG MSS allocations. As the Commission is aware, a record was developed in the WRC-95 and WRC-97 preparatory processes demonstrating a need for additional NVNG MSS allocations. WRC-95 established the baseline requirements for future allocations for the NVNG MSS in Resolution 214 which stated "that in order to meet projected MSS requirements below 1 GHz, a range of an additional 7 to 10 MHz will be required in the near future." The WRC-97 Industry Advisory Committee Report concluded "there is insufficient spectrum available beginning in the year 2000 to accommodate the requirements of the NVNG MSS below 1 GHz service. For systems planned to be implemented around the year 2000 and later, there does not currently appear to be sufficient worldwide access in the available bands for such systems to grow and achieve commercial viability. Given the time required to develop and construct satellite systems, an additional 21 MHz (24.7 MHz minus the existing 3.5) on a worldwide basis is required in the immediate future if the requirements for the NVNG MSS below 1 GHz are to be met."¹ Based on this record, the Commission concluded in the Notice in this proceeding that "additional spectrum for NVNG MSS is needed to facilitate the competitive development of the Little LEO service."² Final Analysis, Leo One USA and Orbcomm all filed comments in this proceeding reviewing the various studies, reports and resolutions that

¹ See Industry Advisory Committee, Informal Working Group 2A Final Report at 7-10.

² Notice of Proposed Rulemaking, ET Docket No. 97-214, at para. 9 (October 14, 1997).

demonstrate the need for additional NVNG MSS spectrum. None of the other commenters have provided any empirical evidence that the requirements for additional NVNG MSS allocations do not exist. Given this record, there is no question that the NVNG MSS has an immediate need for additional allocations.

II. NVNG MSS Can Operate in the Proposed Bands Without Harming the Operations of Existing Services.

A number of parties in this proceeding expressed a need to maintain reliable communications for existing services. Leo One USA fully understands that NVNG MSS use of the 455-456 MHz and 459-460 MHz bands must be accomplished in a manner that allows existing users to continue to meet their operational requirements. Contrary to the superficial view of some commenters, the technical operations of FDMA NVNG MSS systems will not inhibit the operational requirements of existing users.³

NVNG MSS and the existing services in the proposed bands operate on intermittent basis. For an interference event to occur the NVNG MSS terminal and the victim terminal must be in close proximity, on the same channel, and the victim unit must be receiving at the precise time that the NVNG MSS terminal transmits. The statistical likelihood of such an event occurring is negligible. Furthermore, FDMA NVNG MSS systems are designed to provide additional protection by actively avoiding the operations of terrestrial services. Specifically, NVNG MSS systems that would use

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A degradation of less than 0.1 percent in availability of a channel for the Land Mobile Service has been considered acceptable degradation even for critical terrestrial systems for public safety use agencies, utilities and petroleum companies. *See* ITU-R Document 8A/TGMP/35, November 1995 at 5.

FDMA uplinks⁴ in the 455-456 MHz and 459-460 MHz bands will operate with band-scanning receivers on a satellite that searches throughout the entire satellite footprint for channels that are temporarily unused by terrestrial systems. This footprint is as wide as the entire continental United States ("CONUS"). When an unused channel is found, that channel would be made available for NVNG MSS uplink transmissions. Thus, uplink transmissions would be authorized only on channels that are not being used by the terrestrial systems.⁵

Contrary to the conclusion of the Land Mobile Communications Council ("LMCC"), sharing studies have been prepared that examine the ability of NVNG MSS systems to share with existing users. These studies have been submitted to the FCC and ITU-R and demonstrate that interference caused by an NVNG MSS system into an existing terrestrial service is negligible. Specifically, Appendix A to these reply comments provides some of the analyses conducted in 1996 and 1997 as part of the preparations for WRC-97. The following nine documents analyze the ability of the NVNG MSS to share with terrestrial services:

- Item 9 (10/21/96) presents the analyses provided in the WRC-97 Advisory Committee (WAC-97), Working Group IWG-2A, and expands the earlier analyses to include digitally modulated systems and systems operating at 460 MHz, and uses land mobile equipment technical characteristics provided by land mobile interests. The conclusion of these analyses is that it is feasible for narrowband non-GSO MSS uplinks using dynamic channel assignment techniques to share spectrum with land mobile service systems with the characteristics as modeled.
- Item 8 (10/21/96), a US input document to ITU-R Working Party 8D, provides: a description of the dynamic channel assignment technique used by the MSS network to avoid active land mobile channels and thereby avoid interference; provides

⁴ It should be noted that no party has filed comments advocating that CDMA systems can successfully share the proposed spectrum. Thus, Leo One USA urges the Commission to restrict its allocation of this spectrum to FDMA/TDMA NVNG MSS systems.

⁵ An NVNG MSS packet transfer cannot be successfully completed unless it is transmitted on an unused channel.

analyses and simulations that demonstrate low probabilities of interference; and concludes that the results of the analyses and simulations show that only infrequent interference to the land mobile service would result.

- Item 7 (11/5/96) is an output document from ITU-R Working Party 8D that concludes that an additional 21 MHz of spectrum is required for NGSO MSS services below 1 GHz, based on market studies of the demand for those services.
- Item 6 (11/5/96) is an output document from ITU-R Working Party 8D that summarizes analyses performed within Working Party 8D and concludes that it is feasible for narrow-band non-GSO MSS uplinks (using dynamic channel assignment techniques) to share spectrum with land mobile services in the bands below 1 GHz.
- Item 5 (11/5/96) is an ITU-R Working Party 8D Preliminary Draft New Recommendation ("PDNR") on a method for the statistical modeling of frequency sharing between the land mobile service and NVNG MSS uplinks. This PDNR incorporates the methods used by Leo One USA in modeling the frequency sharing between terrestrial systems and the NVNG MSS.
- Item 4 (2/5/97) is a concise argument (developed within WAC-97, IWG-2A) for cooperative frequency sharing between the land mobile service and NVNG MSS uplinks in the band 450-470 MHz. It includes extension of the analyses to the typical case where the NVNG MSS satellite has a view of 30 per cent land area. The argument also addresses potential interference as an impact on the terrestrial service channel availability. It is argued that the analyses provided to IWG-2A indicate that the potential interference would degrade the availability of a channel for LMS use by much less than 0.1 per cent. This value is considered acceptable degradation even for critical terrestrial systems for public safety use agencies, utilities and petroleum companies. (See ITU-R Document 8A/TEMP/35, 5 November 1996.) The conclusion is that co-frequency sharing between LMS systems and NVNG MSS systems has been shown to be feasible under a regimen where the burden of sharing is born entirely by the MSS system, as proposed by the Commission in the Notice.
- Item 3 (2/13/97) is a WAC-97, IWG-2A input document that responds to concerns raised by land mobile interests and applies the prior analyses to additional scenarios including increased base station antenna height, use of repeaters, and effects of re-farming on sharing. The document also clarifies several technical points relative to the analyses, including LMS channel availability, squelch activation, and Doppler shift.
- Item 2 (3/13/97) is a summary of analyses supporting shared allocations in the 450-470 MHz bands, as presented to the FCC Wireless Bureau. The conclusion is that

frequency sharing between non-GSO MSS uplinks and land mobile service stations is feasible in the frequency bands 450-470 MHz.

- Item 1 (7/17/97) provides additional analytic support of MSS and LMS co-frequency sharing, including: band-scanning receiver sensitivity to short duration signals; deviations from the worst-case analyses used in the prior baseline scenarios; use of repeaters by LMS systems; and varying traffic loading rates. This document responds to technical points raised by land mobile interests.

Collectively these analyses demonstrate that co-frequency sharing between terrestrial services and NVNG MSS uplinks is feasible and there is a sound technical basis for the Commission to allocate the 455-456 MHz and 459-460 MHz to the NVNG MSS. Specifically, these studies demonstrate that the operational requirements of terrestrial systems were maintained when the NVNG MSS and terrestrial services share the same frequency. A baseline scenario was examined, with analyses for both analog and digital signals at the 148 MHz and 460 MHz frequencies, and for mobile terrestrial receivers. Even where the scanning device was not in operation, the probabilities of interference⁶ were found to be extremely low, ranging from once every 11 hours to once every 21 months within the range of parameters examined. These analyses were further refined to take account of additional elements including: high elevation base station antennas, the use of repeaters, and the effects of "re-farming." As discussed below, none of these variables changed the conclusion that NVNG MSS systems would not impact the operational requirements of terrestrial systems when these two services share the same spectrum. The added protection of band-scanning will reduce the likelihood of interference to almost zero. Band-scanning will detect and avoid channels that are in

⁶ An interference event is observed as a single "click" or "pop" (an MES is limited to a single transmission on any one channel). Since the terrestrial environment can be noisy, it would be unlikely that the user would be able to distinguish an occasional "click" or "pop" due to mobile earth station transmissions from environmental background noise radiated by automobiles, power-generating facilities, and industrial equipment. In the case of land mobile, intra-service interference, that is interference from other land mobile users, can be a much more significant problem in the mobile service bands than potential interference from non-GSO MSS networks.

use by all terrestrial transmitters including broadcast remote pickup, paging, mobile telephone, or air-ground telephony. The band-scanning receivers on the satellites can identify terrestrial channels that are currently in use operating at 22 mW of power in 16 kHz bandwidth.

III. The NVNG MSS Can Successfully Share With Air-to-Ground Telephone Systems

Twenty companies submitted comments arguing that Little LEOs will disrupt the air-to-ground telephone service. These form letters ask the Commission to “consider the negative impact any sharing allocation within the air-to-ground segment of this proposed rule making will have on all users. . . .” Nevertheless, these commenters fail to provide specific examples of how the air-to-ground service would be harmed. As Leo One USA has demonstrated above, and on numerous previous occasions, the statistical probability of interference to terrestrial systems resulting from the operations of NVNG MSS is negligible when band-scanning is *not* used. However, the introduction of band-scanning techniques provides further assurance that the air-to-ground and NVNG MSS services can operate in the same frequency in a manner that allows both services to meet their operational requirements.

FreePage Corporation contends that the NVNG MSS satellite will not be able to detect air-to-ground transmissions because the aircraft ERP is “only 4 to 25 watts.”⁷ As Leo One USA explained previously, the NVNG MSS satellite band-scanning receiver can detect signals as low as 22 mW in 16 kHz bandwidth. Thus, the NVNG MSS system can easily detect air-to-ground transmissions. The ability to reliably detect active channels on the air-to-ground channels is further enhanced by the clear line-of-sight that would inevitably exist from an aircraft in flight to the satellite. FreePage

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See FreePage Comments at para. 11.

further states “that the [air-to-ground] ground stations will receive heavy interference from uplinks located on the near-random ubiquitous basis. . . .”⁸ FreePage evidently has not taken the time to evaluate the statistical probability of an interference event and does not understand that NVNG MSS uplinks are designed not to transmit on any *active* air-to-ground communication channels.⁹ Thus, no harmful interference will occur to the existing terrestrial service from the proposed MSS allocation. FreePage expressed additional concern that a nearby NVNG MSS uplink may “lock up” a talk channel or break the squelch.¹⁰ This is ridiculous. The short duration and low duty cycle of the FDMA MSS uplink transmissions preclude both of these events from occurring. Additionally, regardless of availability, the uplink NVNG MSS transmitter can be programmed not to use the same uplink channel repeatedly.

FreePage also is concerned that an NVNG MSS uplink may block a “Request to send” from an aircraft, on the aircraft signaling channel at 459.675 MHz.¹¹ It is self-evident that the short duration of the NVNG MSS signal and low duty cycle preclude this scenario from occurring repeatedly. If a single, short term interference did occur, the air-to-ground system would deal with it in the same manner that it would deal with a “Request to send” message that failed for any other reason. It would try again. FreePage raises additional questions regarding the availability of band-scanning technology. As the Commission is aware, ORBCOMM has already demonstrated in an operational system the ability to identify channels used by existing terrestrial services and the

⁸ *Id.* at para. 12.

⁹ It would not be possible for an NVNG MSS system to complete a transmission on a channel that is actively in use by air-to-ground stations.

¹⁰ FreePage Comments at para. 15.

¹¹ *Id.* at para. 16.

assignment of open channels for NVNG MSS uplinks. Given this background, there should be no question regarding the availability of the dynamic channel assignment technology for interference avoidance.

Mobile Telecommunications Technologies Corp. (Mtel) argues that "there simply is no further room for spectrum sharing capacity in the 459-460 MHz band."¹² However, no analysis is provided to support this statement. Mtel further states that "the Commission's proposal to provide co-primary status between air-ground and Little Leo systems would decrease the available spectrum for existing and future air-ground needs."¹³ This is nonsense. The Commission's proposals do not decrease the bandwidth available to meet the current and future needs of existing services. The proposed allocations to the NVNG MSS would allow the air-to-ground service to maintain its system operation with no change in channelization or number of channels in use. The spectrum sharing with the NVNG MSS would be on a time-shared basis, with the NVNG MSS transmitting on channels that are temporarily unused by the air-to-ground service.

Mtel further states "there is no way to control separation between aircraft themselves and Little Leo uplink facilities."¹⁴ Mtel's lack of understanding of the proposed frequency sharing between the NVNG MSS and the air-to-ground service is self-evident. Again, Mtel has failed to examine the statistical likelihood of an NVNG MSS transmitter transmitting on the same channel that is being used by an air-to-ground transmitter, at the same time and in a geographic location that could cause an interference event. Furthermore, Mtel fails to grasp that the NVNG MSS uses band-

¹² Mtel Comments at para. 4.

¹³ *Id.* at para. 7.

¹⁴ *Id.* at para. 9.

scanning devices that allow NVNG MSS uplink transmissions only on channels that are temporarily not in use by the air-to-ground service. The separation between the aircraft and the Little LEO uplink is not relevant to the interference potential, rather it is the separation between the air-ground receiver and the Little Leo uplink transmitter.

Mtel also states that, "interference is a principal problem plaguing existing air-to-ground communications today."¹⁵ This problem occurs at least partly because the air-to-ground service user does not know which channels are currently in operation. This situation creates self-interference. This is the precise problem that the NVNG MSS avoids by using band-scanning receivers on the satellite to identify unused channels.

None of the comments regarding sharing between NVNG MSS and the air-to-ground service provide any technical analysis indicating how the air-to-ground service would be harmed. All the evidence indicates the probabilities of an interference event coupled with the use of band scanning¹⁶ virtually preclude the NVNG MSS from interfering with air-to-ground operations.

IV. NVNG MSS and Broadcast Remote Pick-Up Can Successfully Share the 455-456 MHz Band

As in the case with the air-to-ground systems, the probabilities of an interference event to a broadcast remote pick-up ("RPU") is negligible, even when band-scanning is not used. However, an NVNG MSS satellite will scan throughout its entire footprint to determine whether there are any operational RPU systems in use at any given time. The NVNG MSS system can then assign unused channels for NVNG MSS uplink transmissions. In order to further substantiate the conclusion that

¹⁵ *Id.*

¹⁶ Band-scanning for air-to-ground services should be highly effective, since there will almost always be a clear line-of-site between the air-to-ground radio and the NVNG MSS satellite.

NVNG MSS and RPU could share, Leo One USA commissioned a new analysis of this issue which appears in Appendix B to these comments. In the scenario analyzed, the RPU has an antenna with 5 dBi gain and 15 meters height. The receiver for the RPU has an associated antenna with 9 dBi gain and 60 meters height. Channelization of 25 kHz is used. A $C/(I+N)$ of 17 dB is assumed for acceptable operations. These are representative values for RPUs. The NVNG MSS uplink is modeled with 7 W transmitter power, 2 meter antenna height, and 0 dBi gain in the direction of the RPU receive station. The MSS uplink is modeled with 8.2 kHz emission bandwidth. The MSS network band-scanning receivers are modeled at 99.8% effective in detecting the operating RPU transmitters. A full list of the assumptions and the simulation model used are given in Appendix B. The simulation used 500 million trials to calculate the probability of interference from an NVNG MSS uplink to an RPU link, both operating in the 455-456 MHz band. The results show that, with the worst-case assumptions used in the modeling, the probability of interference is only 0.00015%. This is equivalent to a single short, less than one-half second interference event every 4 days, assuming that the RPU is operating continuously for that period. If the RPU operated for only 2.5 hours per day, then the average interval between short, on-half second, interference events would be about a month. These results demonstrate the feasibility of co-frequency sharing between NVNG MSS uplinks and remote pickup units operating in the Broadcast Auxiliary Service.

Like the air-to-ground comments, those parties commenting on this sharing situation also appear to lack knowledge on how the NVNG MSS system will operate. For instance, the University of California ("UC") and Bill Jones Broadcast Engineering ("Bill Jones") question whether the scanning NVNG MSS receiver would have sufficient sensitivity to detect an active transmitter in a

RPU.¹⁷ For example, Bill Jones extrapolates the 3.5 mW sensitivity in 2.5 kHz to 140 mW sensitivity in 100 kHz and conclude that it is unlikely that a satellite unit located behind the RPU antenna would be able to detect the RPU transmitter which could have a power output of less than 15 W.¹⁸ However, the sensitivity analysis that produced the 3.5 mW sensitivity specified in the Notice used a gain of -2 dBi towards the satellite. If the back lobe is -10 dBi (the number used in ITU-R interference modeling), the scanning NVNG MSS receiver with 100 kHz bandwidth could detect an RPU transmitter of 0.9 W when located behind the ground antenna. Thus, the band-scanning receiver could readily detect the RPU transmitters, and the simultaneous co-channel operation of NVNG MSS uplinks and RPU transmitters would be avoided.

Bill Jones also contends that long periods of RPU operation, “sometimes up to 6 hours”¹⁹ increase the likelihood of harmful interference. However, the opposite is true. With continuous operation of an RPU on a given channel, the band-scanning receiver always identifies that channel as being in use, and the NVNG MSS uplink transmitters are not assigned the channel in-use by the RPU. Because of the large antenna beam of the NVNG MSS satellites, all mobile earth stations within the antenna beam coverage pattern of the NVNG MSS satellite are also precluded from uplink transmission within the bandwidth of that channel for the entire period of use by the single RPU.

In their comments, both UC and Bill Jones assign to the San Francisco Bay area a one per cent share of the total projected NVNG MSS market of 40 million users.²⁰ They conclude that if the

¹⁷ See UC Comments, Bill Jones Comments.

¹⁸ Bill Jones Comments at para. 5.

¹⁹ *Id.* at para. 6.

²⁰ UC Comments at para. 3, Bill Jones Comments at para. 4.

entire 455-456 MHz band were to be used for NVNG MSS, the result would be one-half-second transmission per user every 13 minutes, which they consider “very unlikely” to be sufficient for most users.²¹ There are a number of flawed assumptions in this analysis. First, it is incorrect to assume that all 40 million users could be satisfied in one MHz of spectrum if their data demands require more spectrum. Second, certain users, such as utilities performing automated meter readings, could be satisfied with as little as one-half second transmission per month. The proposed allocations to the NVNG MSS are co-primary allocations to be shared with the existing terrestrial services, and any conclusions about the sufficiency of NVNG MSS transmissions would have to take account of the types of users, the data demands of users, the capacity of the NVNG MSS systems operating in the band, and many other factors.

The UC suggests certain changes to Part 74 of the FCC’s Rules.²² Leo One USA believes these changes are unnecessary in light of the Commission’s proposed domestic allocation to the NVNG MSS on a co-primary basis, subject to the provisions of international footnotes S5.286A, B, and C. Footnotes B and C provide the needed protection from interference for the existing terrestrial systems.

James Madison University (“JMU”) and the University of Utah express concern with regard to possible interference resulting from the malfunction of NVNG MSS uplink transmitters.²³ If a malfunctioning NVNG MSS transmitter either operated continuously or on the wrong channels, it would be extremely disruptive to the operations of the entire NVNG MSS system. Thus, the NVNG

²¹ UC Comments at para. 3, Bill Jones Comments at para. 4.

²² UC Comments at para. 5.

²³ JMU Comments at para. 13, University of Utah Comments at para. 14.

MSS operator has significant incentive to insure that transmitters do not malfunction. With this goal in mind, the NVNG MSS satellite maintains direct control of all uplink transmitters. Furthermore, the units would be designed to be fail-safe to avoid potentially disruptive failure modes.

JMU, the UC, and the University of Utah express concern that the use of RPU in emergency situations may be disrupted by NVNG MSS operations.²⁴ Again, this concern cannot withstand technical scrutiny. In those emergency cases where the RPU transmitters are being used continuously, the band-scanning receivers on the NVNG MSS satellite would not permit the use of these channels for NVNG MSS uplinks. Additionally, if it were determined to be in the public interest in an extreme emergency situation, all NVNG MSS uplink transmitters in certain areas could be prevented from transmitting.

The University of Utah notes that “during pauses in program audio when the entire channel is not actively occupied with radio frequency energy but the broadcast RPU receiver with it’s audio output still on-the-air is detecting everything being sent within that channel, the satellite born receiver would think portions of the channel were available for NVNG MSS activity, and give terrestrial NVNG MSS units the go ahead to send data within the channel currently being used for a live remote broadcast.”²⁵ It would be possible to avoid this situation by using a bandwidth in the band-scanning receiver that is equal to the channel bandwidth of the terrestrial system. This would allow the NVNG MSS system to detect an unmodulated or slightly modulated carrier. For RPUs that use digital modulation where there is always a bit stream to modulate the carrier, the energy would be dispersed over the channel bandwidth and the terrestrial transmitter activity could be detected

²⁴ See JMU Comments at para. 9, UC Comments at para. 5, University of Utah Comments at para. 10.

²⁵ University of Utah Comments at para. 8.

with a narrower bandwidth in the band-scanning receiver. For digital band-scanning receivers, the bandwidth used could be readily changed by ground command.

The National Association of Broadcasters ("NAB") calculates the number of NVNG MSS uplink transmitters that would be possible in an area if each transmitter is operated at the maximum duty cycle, transmission length, and fully occupies the 455-456 MHz band. The number the NAB calculated is 40,000 uplink transmitters.²⁶ The NAB uses this number to conclude that NVNG MSS and RPU cannot share the 455-456 MHz band. The scenario concocted by the NAB is unrealistic, because it is premised on the NVNG MSS system using all available channels in a particular market. This is not contemplated by the NVNG MSS operator nor is it technically feasible. If the intention of the NVNG MSS operator was to fully use all MSS uplink capacity in one metropolitan area, it would not be necessary to finance and build a NVNG MSS system that had national and worldwide service capabilities. One metropolitan area could be served much more economically from a single tower, or even multiple towers. The keys to understanding the feasibility of sharing between the NVNG MSS and the existing RPU services are the following: (1) the band-scanning receivers on the NVNG MSS satellites must monitor the terrestrial channel usage and only assign uplink transmissions to those portions of the spectrum that are temporarily not in use by terrestrial systems within the entire footprint of the NVNG MSS satellite, and (2) potential interference from NVNG MSS uplinks to terrestrial receivers is a local phenomenon, thus, the operation of an NVNG MSS uplink in Washington, D.C. will not cause interference to a RPU receiver in Philadelphia. Applying these concepts to the NAB scenario, if an RPU is being used in Chicago on Channel X, this UC channel cannot be used anywhere within the beam of the satellite. (The satellite beam size is

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NAB Comments at pg. 3.

typically large enough to cover CONUS.) Consequently, use of a single channel by an RPU in a single location will preclude use of that channel throughout CONUS. Furthermore, when an NVNG MSS uplink is being used in Philadelphia, it cannot be used at the same time in Washington, D.C. or anywhere else within the beam of that satellite. The NAB interference model therefore is not viable because of system operating constraints.

The NAB suggests that RPUs could be subject to continuous interference from Little LEO uplinks for the entire period between scans of the NVNG MSS band-scanning receiver.²⁷ This is wrong. First, as discussed above, even in the absence of a band-scanning device, the statistical likelihood of an interference event is negligible. Additionally, a particular RPU that experiences interference, which is an extremely rare event, will not experience interference again during that period of transmission for several reasons. This is because other NVNG MSS uplink transmitters elsewhere in CONUS, will be assigned to use that uplink channel before the next scan occurs. Moreover, there are limitations on the reuse of the same frequency by the same ground station and once the NVNG MSS band-scanning receiver identifies the channel as in-use, that channel is no longer available to be assigned for NVNG MSS uplinks.

The NAB states that “Little LEO proponents completely failed to obtain worldwide support for the use of the 455-456 MHz bands for their operations.”²⁸ This conclusion belies the facts. A close examination of the Final Acts of WRC-97 reveals that the bands 455-456 MHz and 459-460 MHz were allocated for NVNG MSS by WRC-97 in all three Regions of the world. In Region 2, there is a primary allocation specified for the MSS by an Allocation Table entry. In Regions 1 and

²⁷ *Id.* at pg. 4.

²⁸ *Id.* at pg. 5.

3 there is a primary allocation in certain countries for the MSS specified by footnote. These allocations were agreed to at WRC-97.

ABC, Inc. ("ABC") states that the requisite spectrum sharing capacity to support the proposed allocation of the 455-456 MHz band does not exist and that broadcasters' heavy use of this band does not allow for spectrum sharing with Little LEO operations.²⁹ No analysis is provided whatsoever to demonstrate that RPU use of the band leaves insufficient sharing capacity for the NVNG MSS. ABC's statement is based on mere conjecture and speculation.

ABC further states that "based on the current state of knowledge, it is not feasible to apply engineering techniques to protect broadcast incumbents."³⁰ ABC identifies four scenarios in which the DCAAS technique might fail. A close examination of these scenarios reveals significant technical flaws. First, ABC's assumption that the lack of prior transmission by a particular remote transmitter makes the communication "ripe for disruption by Little LEO" systems is incorrect. If there is any prior or existing use of the channel by any terrestrial transmitter within the beam of the NVNG MSS satellite, the DCAAS system will preclude NVNG MSS uplink use of that channel, and the transmission by the RPU will be unaffected. Second, the 5 W RPU transmitter of the itinerant operation has more than sufficient power to be detectable by the DCAAS system, and the itinerant overlay operation would neither disrupt nor be disrupted by the NVNG MSS. This is because the NVNG MSS transmitter would not operate on the channel at the time a RPU transmitter is using the channel. Third, the low power units in voting receiver systems or repeater systems would have sufficient power to be detectable by the DCAAS system and signal blockage to the satellite is not

²⁹ ABC Comments at pg. 3.

³⁰ *Id.*

likely since satellites are higher than mountains. Fourth, the band-scanning receivers have bandwidths as low as 2.5 kHz and thus can see sideband occupancy and detect which sub-channels are in use and which sub-channels are idle.

The Society of Broadcast Engineers ("SBE") suggests a scenario where a 5-Watt handie-talkie in a terrain-obstructed hole is relaying a report to a mountain-top repeater.³¹ SBE claims that this scenario would cause interference to the RPU because the NVNG MSS satellite cannot hear the handie-talkie. SBE's assumption is wrong. Again, SBE's analysis does not factor in the statistical probability that an NVNG MSS uplink would be transmitting on the same channel, at the same time and in the same location as an RPU. The band-scanning receiver on the NVNG MSS satellite can easily detect a 5 W transmitter. As for possible blockage on the path from the transmitter in a "hole," the satellite is higher than the mountain-top.

SBE suggests that because terrestrial scanners can fail to identify vacant RPU channels, that NVNG MSS scanners may have the same problem.³² It is self-evident that a satellite scanner will have a better view, vis-a-vis a terrestrial scanner, of the RF environment because of high elevation which avoids blockage. The satellite even has a better view than a target "repeater site, or very tall antenna system."

SBE's concern regarding immediate RPU channel availability is misplaced. NVNG MSS uplinks operate short duration and low duty cycle transmissions. An NVNG MSS uplink transmission lasts only 450 ms. The next use of that uplink channel is likely to be in another locality within the beam of the satellite and will not interfere with the initiation of a local RPU transmission.

³¹ SBE Comments at para. 16.

³² *Id.* at para 19.

Thomas C. Smith expresses concern that RPU's placed on high towers have the potential to receive interference from or interfere with a Little LEO uplink.³³ This concern is ill-placed. The visibility of the RPU transmitter on the tower will in fact facilitate the sharing between these two services. This is because there will be a clear look angle between the satellite and the transmitter enabling the NVNG MSS band-scanning receiver on the satellite to identify and avoid the active channels. Mr. Smith's concern regarding the RPU antennas receiving signals from the Little LEO satellites as they come over the horizon is wrong. The satellite downlinks are not in the RPU frequency bands.

Chancellor Media Corp. ("Chancellor") cites the case of a portable transmitter "relaying live audio from inside a building to a mobile repeater vehicle placed in the parking lot."³⁴ It believes that "the transmitter would not be seen by the LEO due to shielding of the building."³⁵ Again, the statistical probability of interference is negligible. An interference event will occur only if a number of specific conditions occur. First, there would need to be no other terrestrial transmitters using that frequency at that time within the beam of the satellite, otherwise the NVNG MSS satellite would see the transmitter and not assign the channel. Second, that frequency must not be in use by any other NVNG MSS uplink within the satellite beam. Finally, there would need to be an active NVNG MSS uplink close enough to the repeater vehicle to cause interference. The statistical likelihood of all of these conditions occurring simultaneously is extremely small.

³³ Thomas C. Smith Comments at pg. 4.

³⁴ Chancellor Comments at pg. 4.

³⁵ *Id.*

Chancellor also suggests that terrestrial users could experience interference at the initiation of each use.³⁶ This view is based on an apparent misunderstanding of the NVNG MSS system operations. First, the maximum continuous interference period for a particular channel is a single uplink transmission of 450 ms. At the end of that transmission, the channel is available to be used by another NVNG MSS uplink, anywhere in the satellite beam. Thus, if transmission number one on Channel A is in Boston, transmission number two on Channel A would be at least 450 ms later and could occur in San Diego and would cause no interference to an RPU link in Boston. Furthermore, if a duty cycle is imposed for the 455-456 MHz band similar to US323, that first uplink transmitter would be precluded from using that same frequency for a period of at least 15 seconds.

V. NVNG MSS Operations Will Not Interfere with Oil Spill Channel Users

Clean Sound Cooperative, Inc. ("Clean Sound") articulates a need to avoid interference or disruption on the 459.000 MHz oil spill channel and asks that the Commission exclude that channel and the adjacent channel from the NVNG MSS allocation.³⁷ Clean Sound provides no analysis that demonstrates that NVNG MSS operations will interfere with, or disrupt with, oil spill communications. The statistical probability and operational techniques described above for air-to-ground and RPU sharing, apply equally to sharing with the oil spill channel. The nature of oil spill operations makes this channel particularly amenable to sharing. The low frequency of use and the geographical distribution of oil spill users would make the 459.000 MHz channel band available for NVNG MSS uplinks much of the time in most of the U.S. Additionally, much of the oil spill operations will be on water or open land, which present clear views from the satellite.

³⁶ Chancellor Comments at pg. 3.

³⁷ Clean Sound Comments at paras. 4 and 6.

The American Petroleum Institute ("API") asks the Commission to exclude 459.000 - 459.050 MHz from the proposed NVNG MSS allocation.³⁸ The basis for this request is API's belief that sharing is infeasible. API references an input paper to the WAC-97, IWG-2A, which is termed as the "LMCC study."³⁹ The LMCC study was rebutted by Addendum to IWG-2A/59 (Rev. 2).⁴⁰ This rebuttal demonstrated that terrestrial land mobile antenna heights and the effects of squelch circuitry still result in very low probabilities of interference with no significant effect on land mobile channel availability. The probabilities of interference discussed above coupled with the use of band-scanning receivers provide sufficient evidence that the risk of interference to the oil spill channel is negligible.

API also notes that "the Commission's Rules provide for the secondary use of the 459.000 MHz channel for general base-mobile operations on a non-interference basis."⁴¹ Thus, the oil spill channel is already being shared with terrestrial users. These secondary users are required to clear the frequency when oil spill containment and clean up activities are present in their area of operation. Under the proposed shared allocation with the NVNG MSS, the satellite systems *would automatically avoid use of the oil spill channel* upon detection of an active terrestrial transmitter at 459.000 MHz. Unlike the terrestrial channel, which would need to be actively cleared to protect oil spill operations, the band-scanning receivers on the NVNG MSS satellite system will automatically

³⁸ API Comments at para. 18.

³⁹ Exhibit A to API Comments, Document IWG-2A/57, by the Land Mobile Communications Council ("LMCC"), 30 July 1996.

⁴⁰ See Appendix A to these Reply Comments for this document.

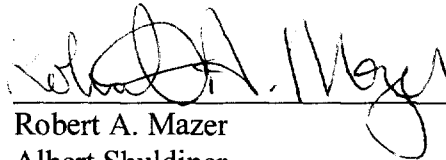
⁴¹ API Comments at para. 7.

clear the channel. It certainly will be quicker and less cumbersome for the NVNG MSS to clear the channel than an existing land mobile operator.

VI. Conclusion

As discussed above, there is an immediate need by the NVNG MSS industry for the proposed allocation. None of the commenters in this proceeding have provided any technical evidence that NVNG MSS systems cannot successfully share the 455-456 MHz and 459-460 MHz with existing users. In fact, all the evidence points to the contrary. The record is replete with technical studies which demonstrate that sharing is feasible. For all these reasons, Leo One USA urges the Commission to allocate the 455-456 MHz and 459-460 MHz bands to the NVNG MSS on a co-primary basis.

Respectfully submitted,

A handwritten signature in dark ink, appearing to read "Robert A. Mazer", is written over a horizontal line.

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